

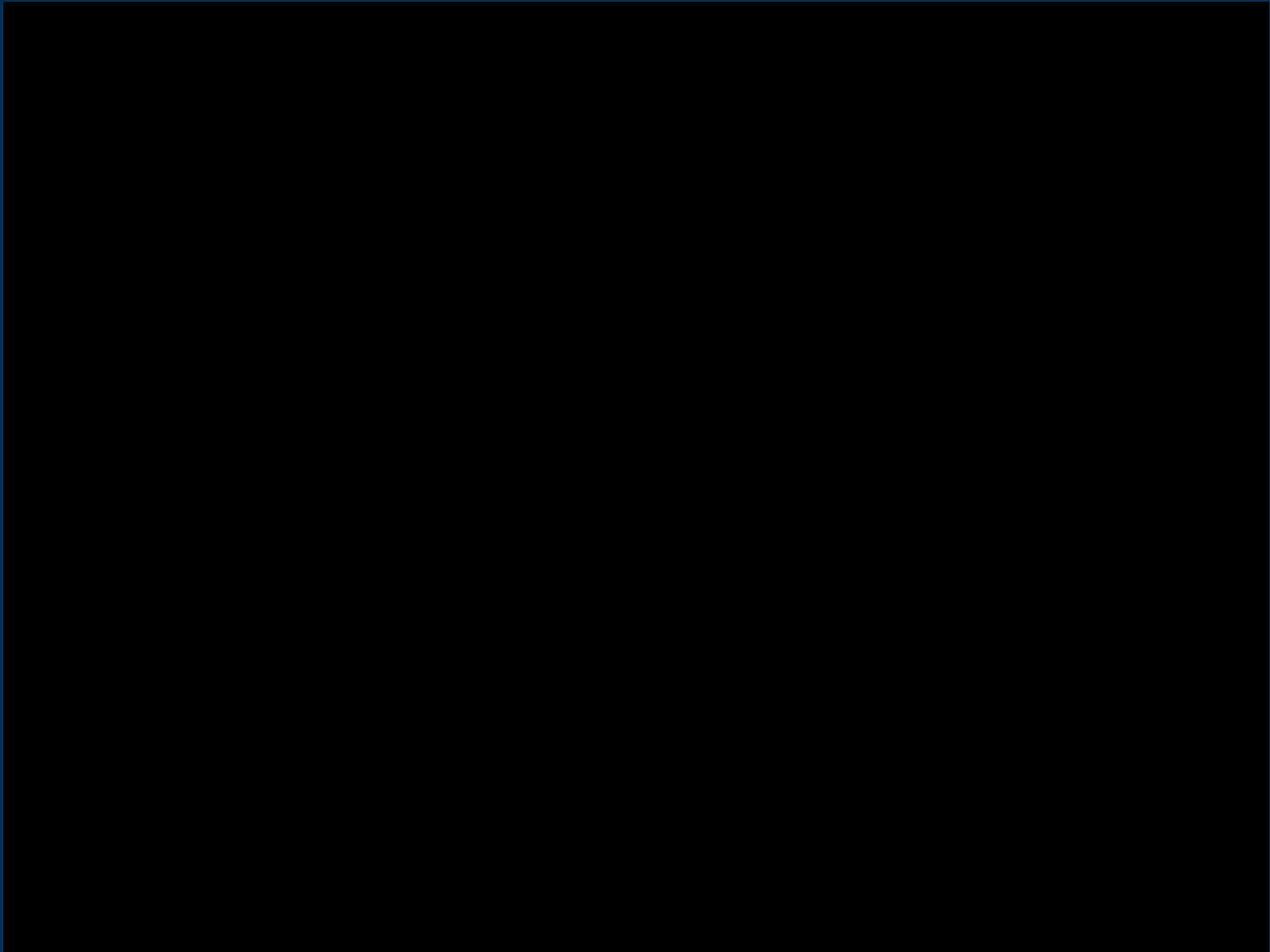


# Water use and monitoring networks in Kentucky

Kentucky Farm Bureau

December 10, 2014

**Video**  
**60-Minutes**  
**“Depleting the water”**



# Water use – Where does the data come from?

All water-use data is available to 2010  
(down to the county level) at:  
[http://waterdata.usgs.gov/ky/nwis/water\\_use/](http://waterdata.usgs.gov/ky/nwis/water_use/)

The screenshot shows a web browser window with the URL [http://waterdata.usgs.gov/ky/nwis/water\\_use/](http://waterdata.usgs.gov/ky/nwis/water_use/). The page features the USGS logo and a banner image. Below the banner, the title "National Water Information System: Web Interface" is displayed. A navigation bar includes "USGS Water Resources" and a search bar with "Data Category: Water Use" and "Geographic Area: Kentucky". A "GO" button is present. A yellow banner contains a link to "Click to hide News Bulletins" and a list of links: "Try our new Mobile-friendly water data site from your mobile device!" and "Full News". The main heading is "Water Use Data for Kentucky". Below it, another yellow banner contains a link to "Click to hide state-specific text". The section "Choose the Year and other Retrieval Criteria." contains three dropdown menus: "Year" (with options from 1985 to 2010, where 2010 is selected), "Area Type" (with options "State Total" and "County", where "State Total" is selected), and "Category" (with a list of categories including "Total Population", "Public Supply", "Commercial", "Domestic", "Industrial", "Total Thermoelectric Power", "Fossil-fuel Thermoelectric Power", "Geothermal Thermoelectric Power", and "Nuclear Thermoelectric Power", where "Total Population" is selected). At the bottom, there are "Submit" and "Reset" buttons.

USGS  
science for a changing world

National Water Information System: Web Interface

USGS Water Resources

Data Category: Water Use Geographic Area: Kentucky GO

Click to hide News Bulletins

- Try our new [Mobile-friendly water data site](#) from your mobile device!
- [Full News](#)

## Water Use Data for Kentucky

Click to hide state-specific text

Choose the Year and other Retrieval Criteria.

-- Year --

-- Area Type --

-- Category --

Submit Reset

# Compiled data is available at: <http://water.usgs.gov/watuse/>

National data is compiled every 5 years; however, states often publish less frequently.

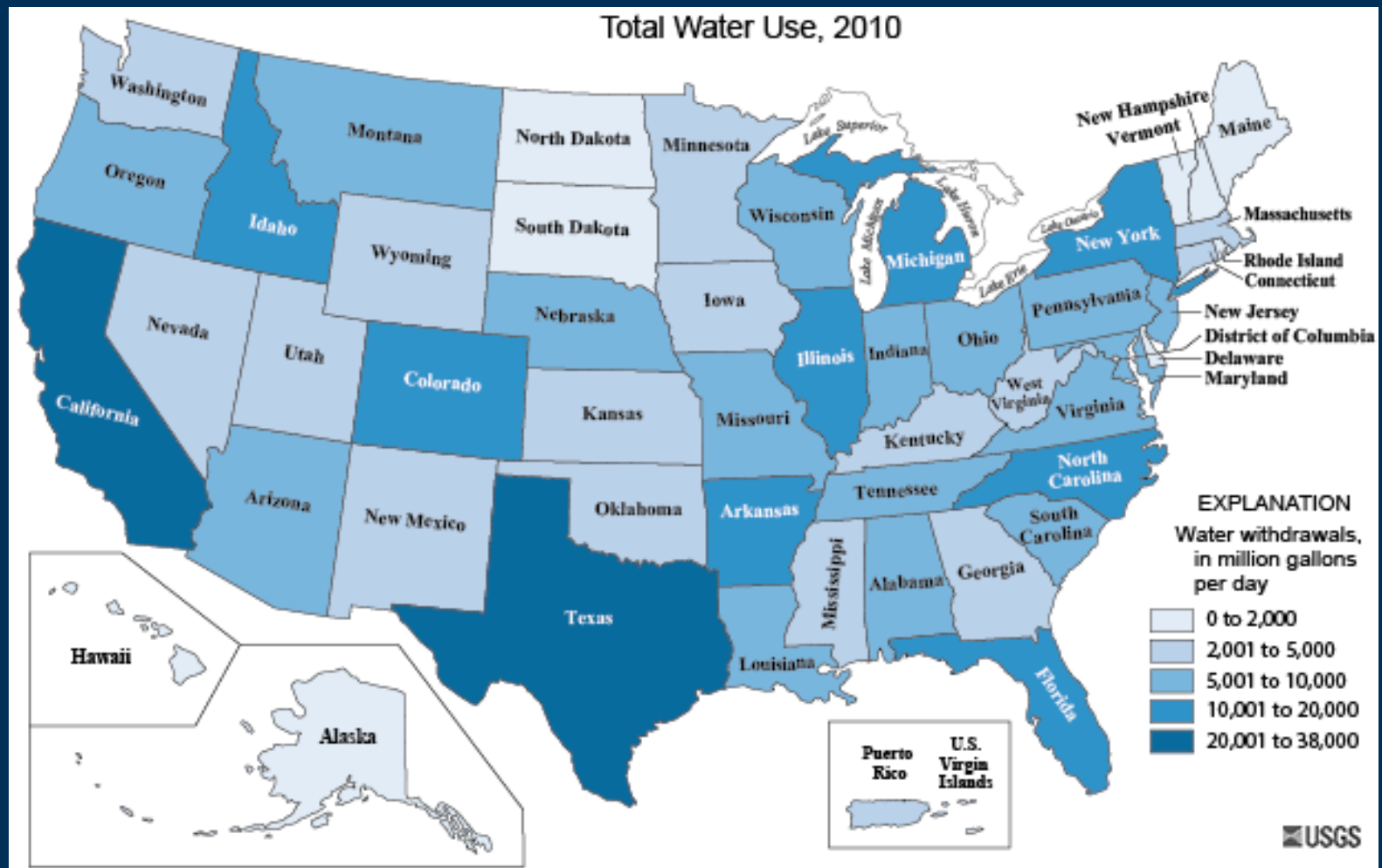
KY published 1995, 2000, and 2005 in a single report – 2010 has not been published (depends on local support)



A screenshot of the USGS website's "Water Use in the United States" page. The page has a blue header with the USGS logo and navigation links. The main content area is white and features a section titled "Water Use in the United States" with a brief description of the program. Below this, there are three columns of information: "Total Water Use", "Surface Water and Groundwater Use", and "Trends in Water Use". Each column includes a small icon and a "More" link. At the bottom, there is a section titled "Categories of water use" with eight images representing different water use categories: Public Supply, Domestic, Irrigation, Thermoelectric Power, Industrial, Mining, Livestock, and Aquaculture. The footer contains links for "Additional Information", "Publications and Data", "Water Use Concepts", and "National Water Use Information Program".

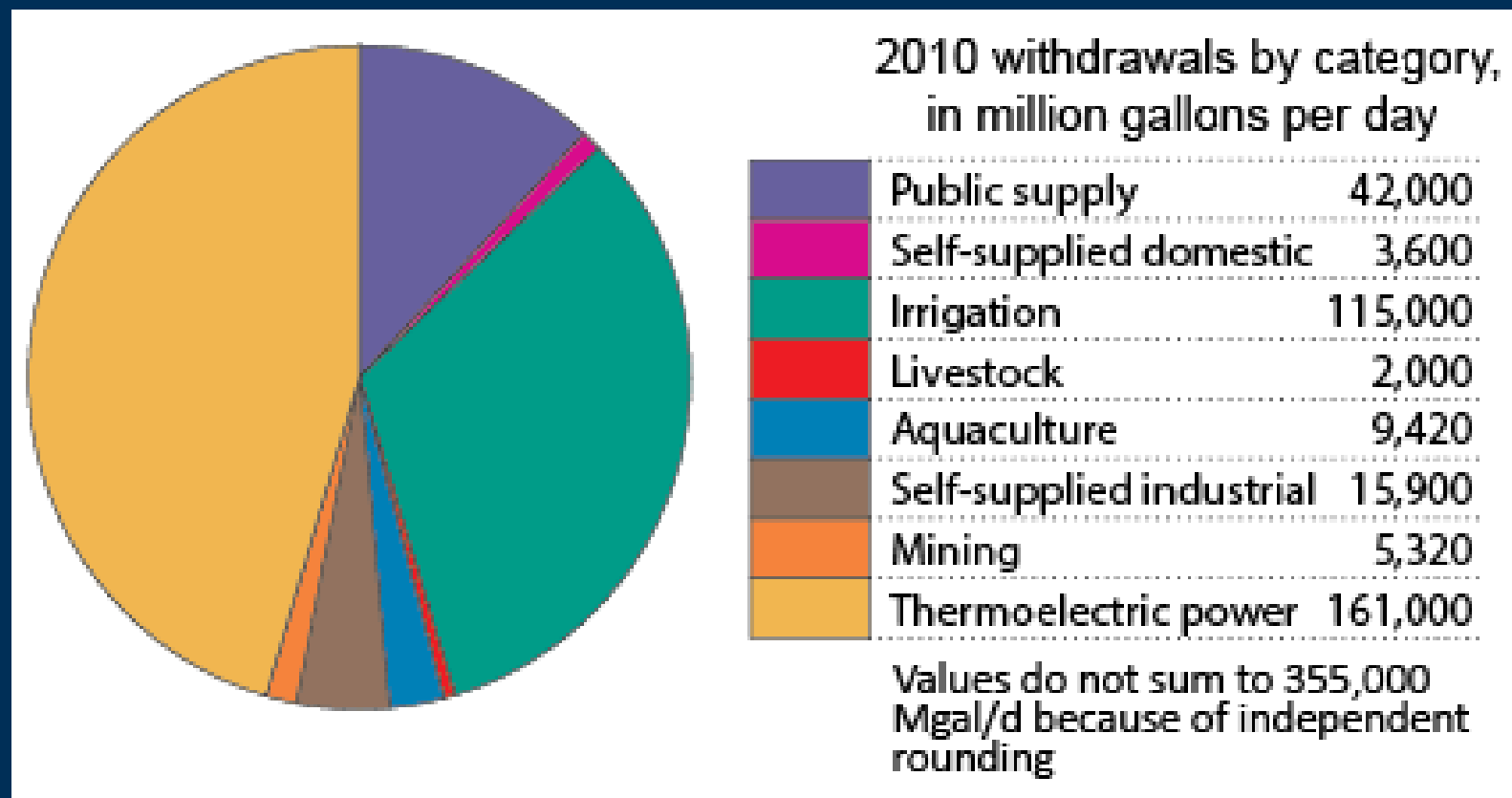
# Water use – a National perspective 2010 data

# Total Water Use, 2010

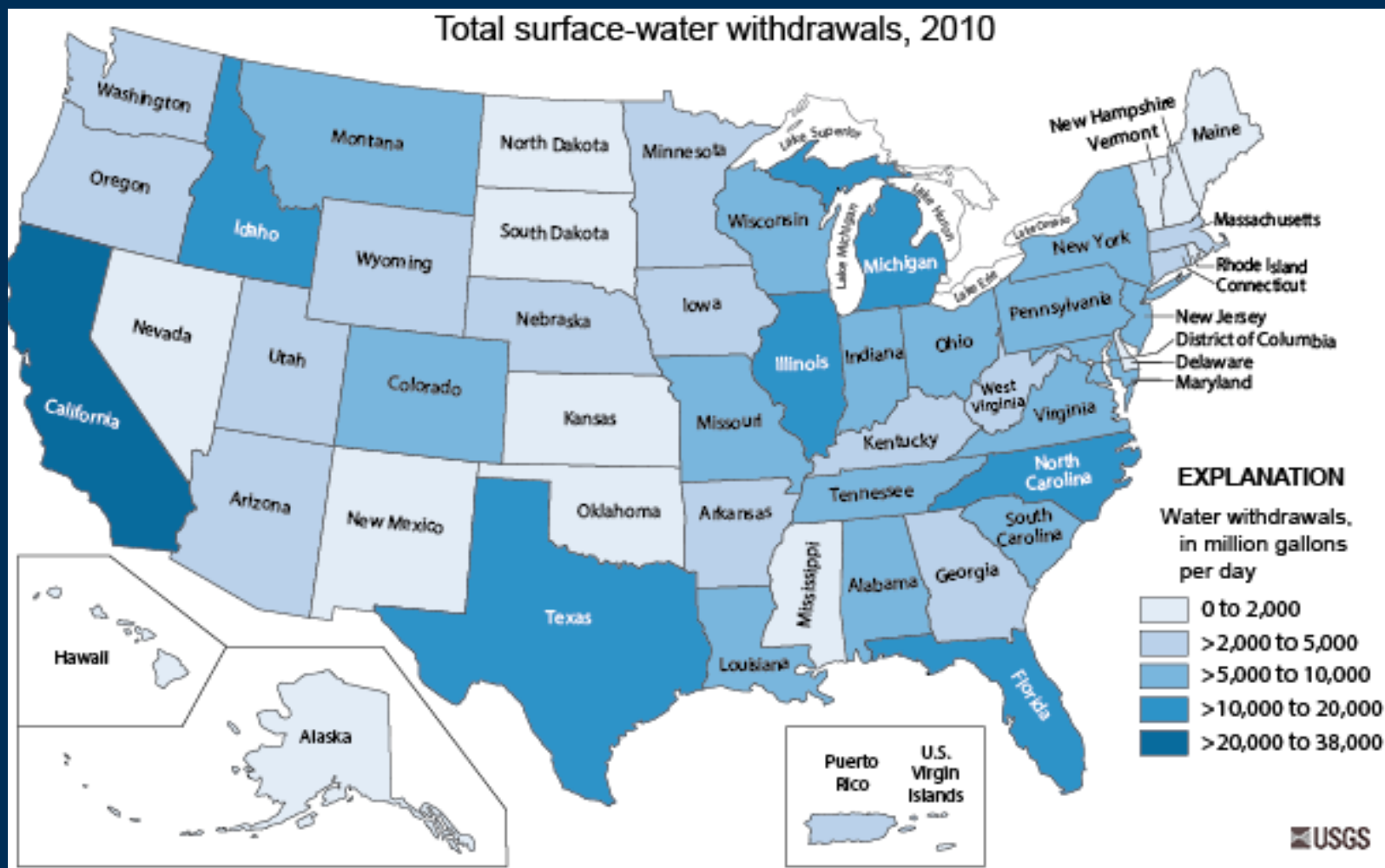




# National withdrawals by category



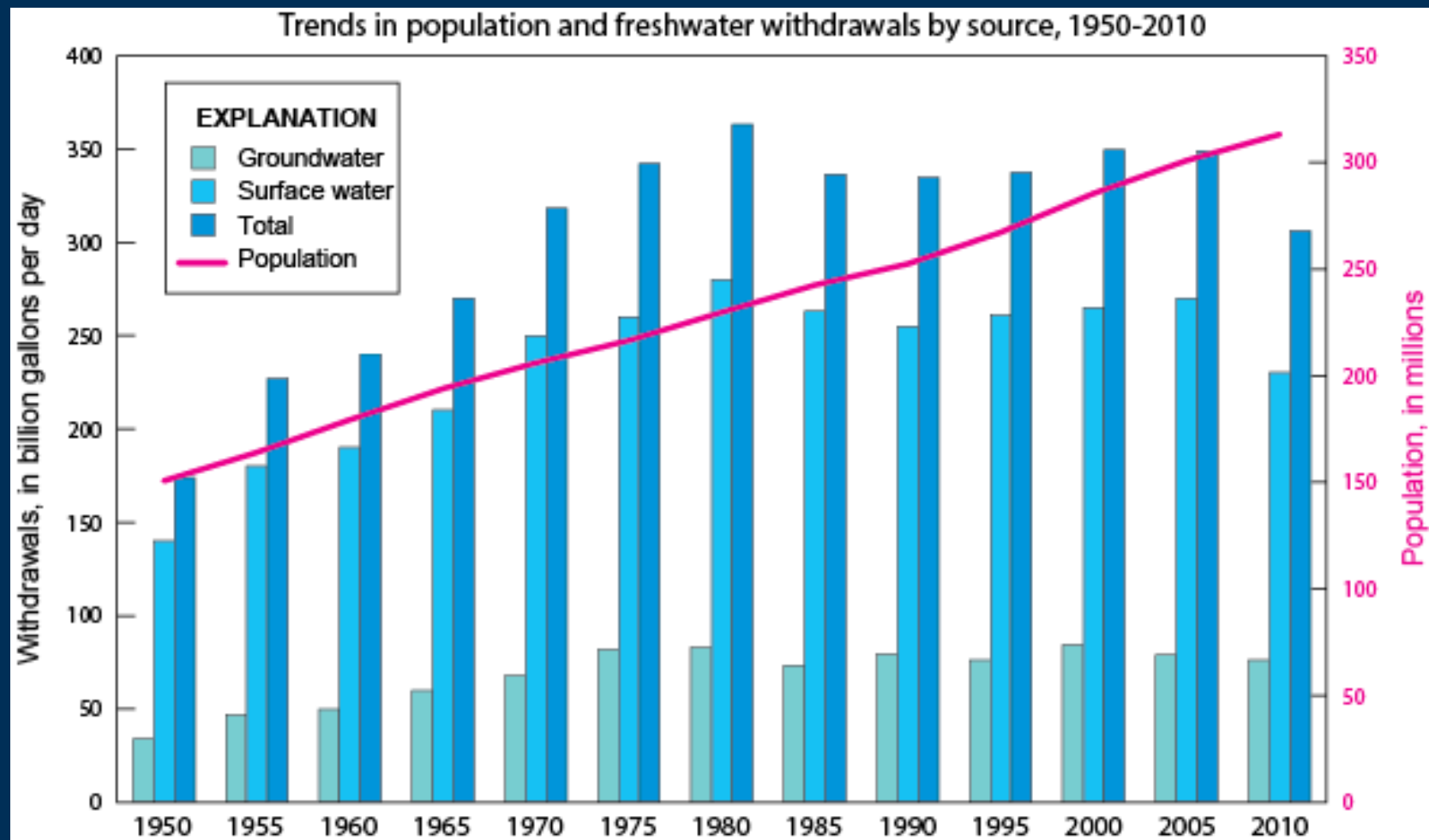
# Surface-water withdrawals, 2010



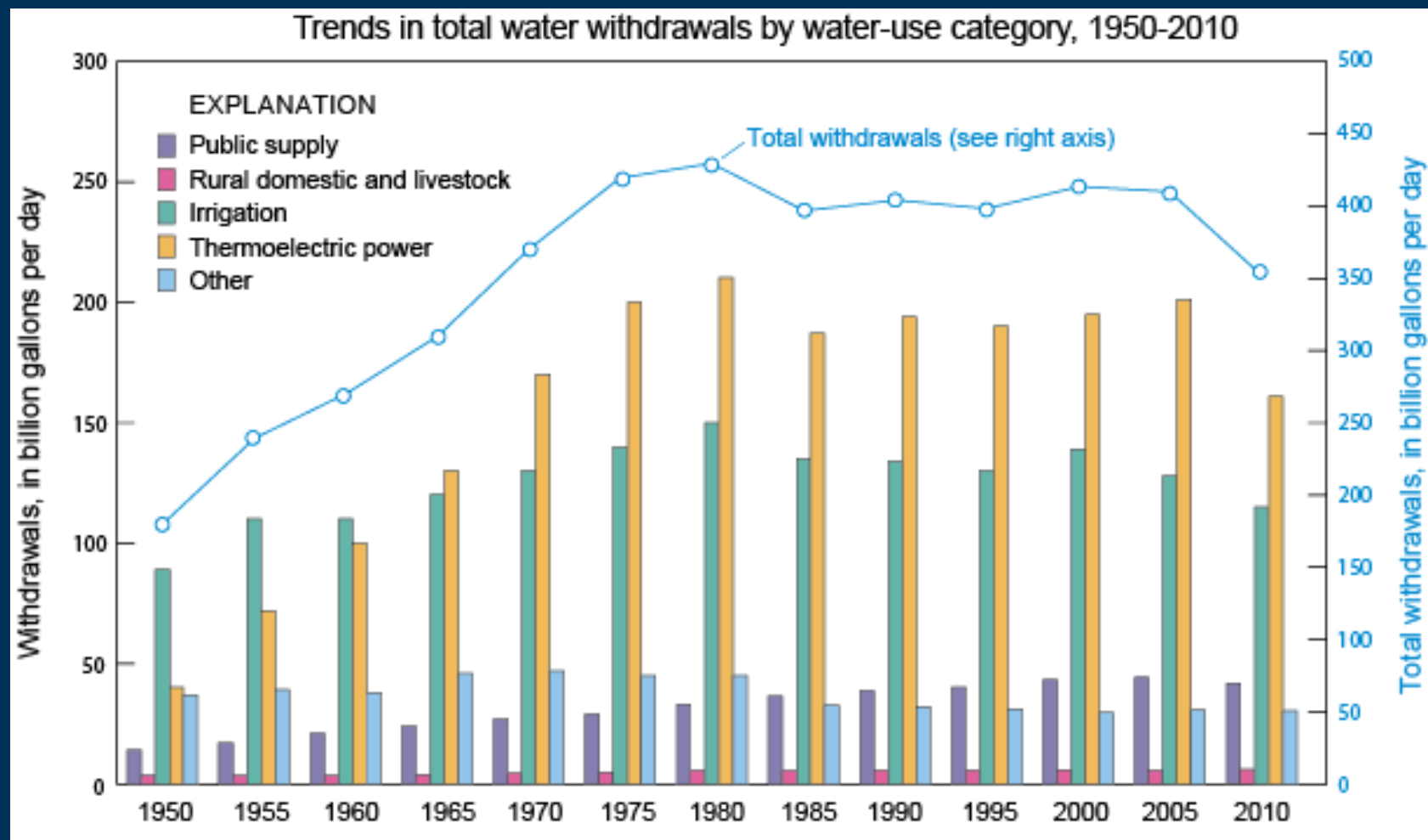
# Groundwater withdrawals, 2010



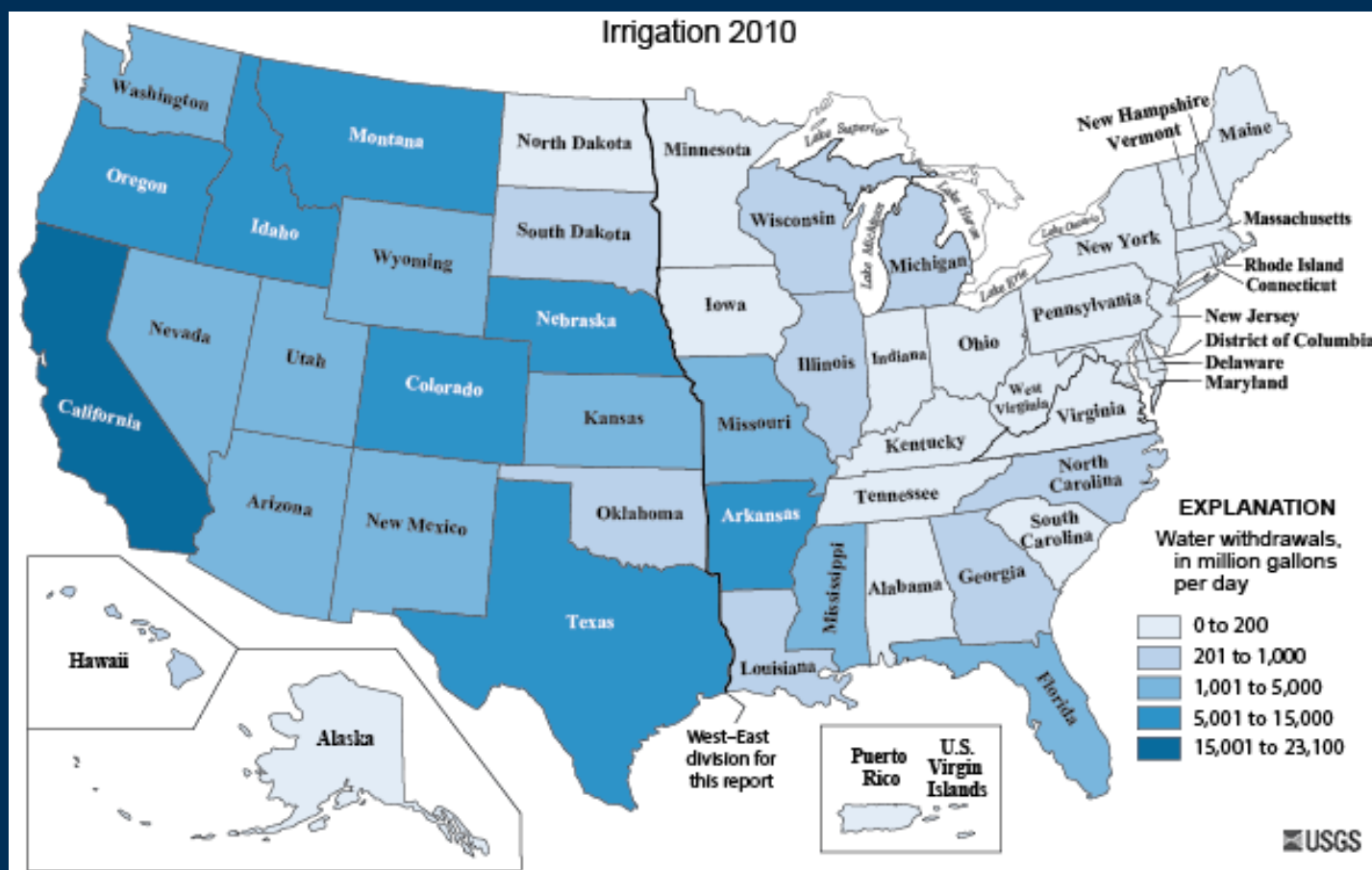
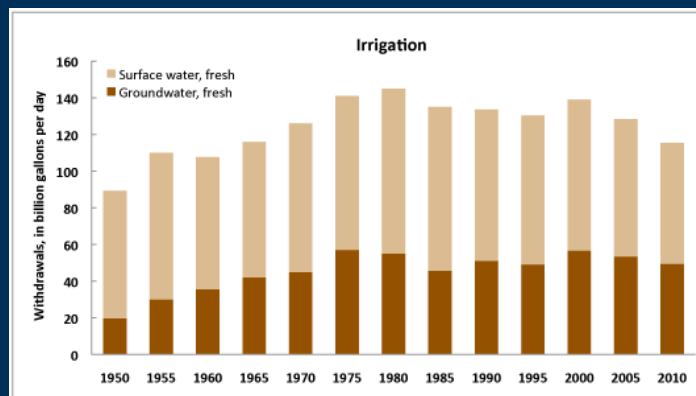
# Trends in population and freshwater withdrawals



# Trends in withdrawals by category



# Irrigation



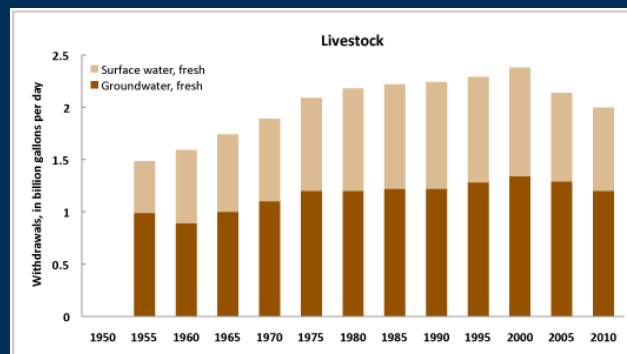
# Irrigation – much work goes into making these estimates!

“Documentation of Methods and Inventory of Irrigation Data Collected for the 2000 and 2005 U.S. Geological Survey Estimated Use of Water in the United States, Comparison of USGS-Compiled Irrigation Data to Other Sources, and Recommendations for Future Compilations”

<http://pubs.usgs.gov/sir/2011/5166/>



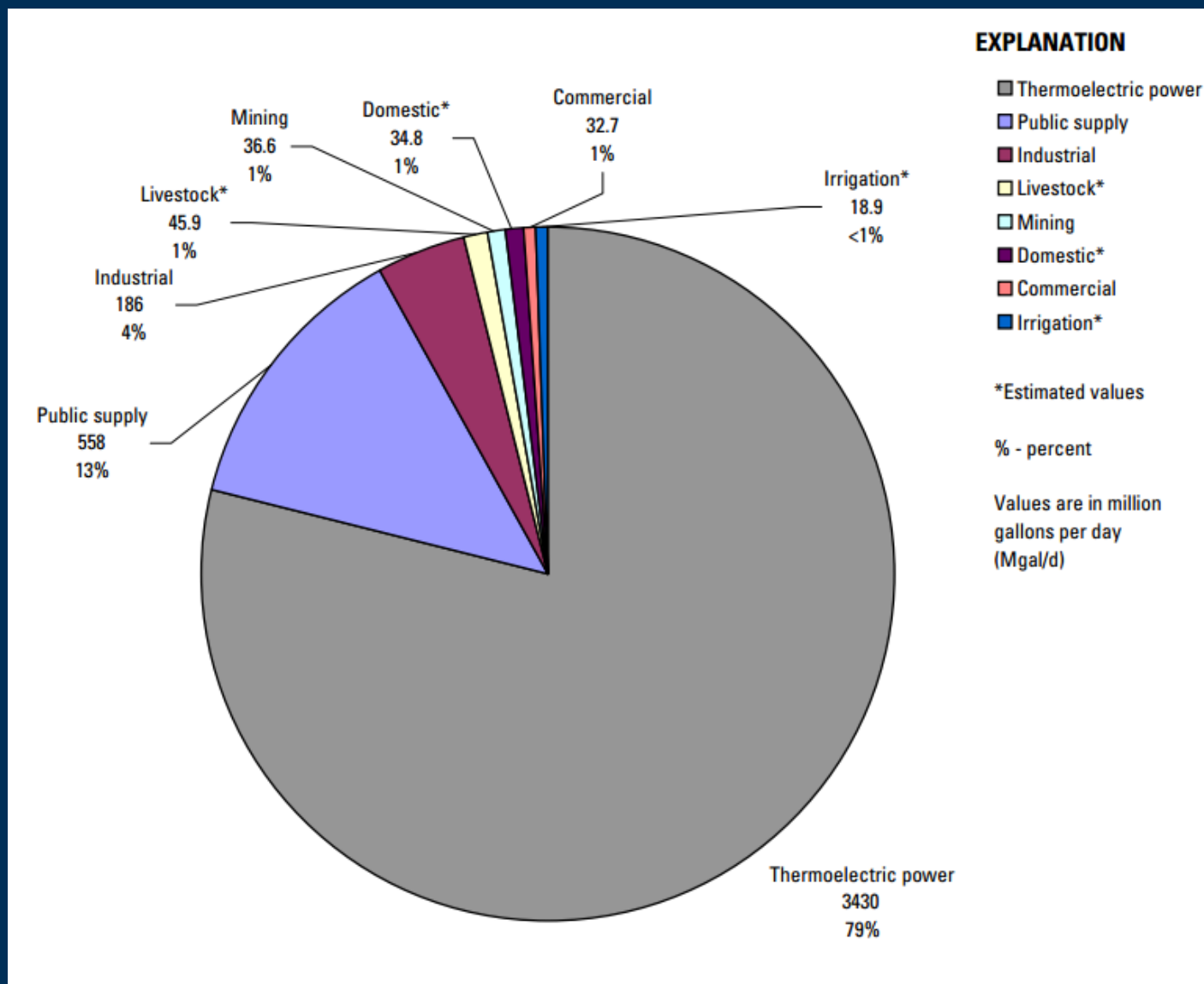
# Livestock



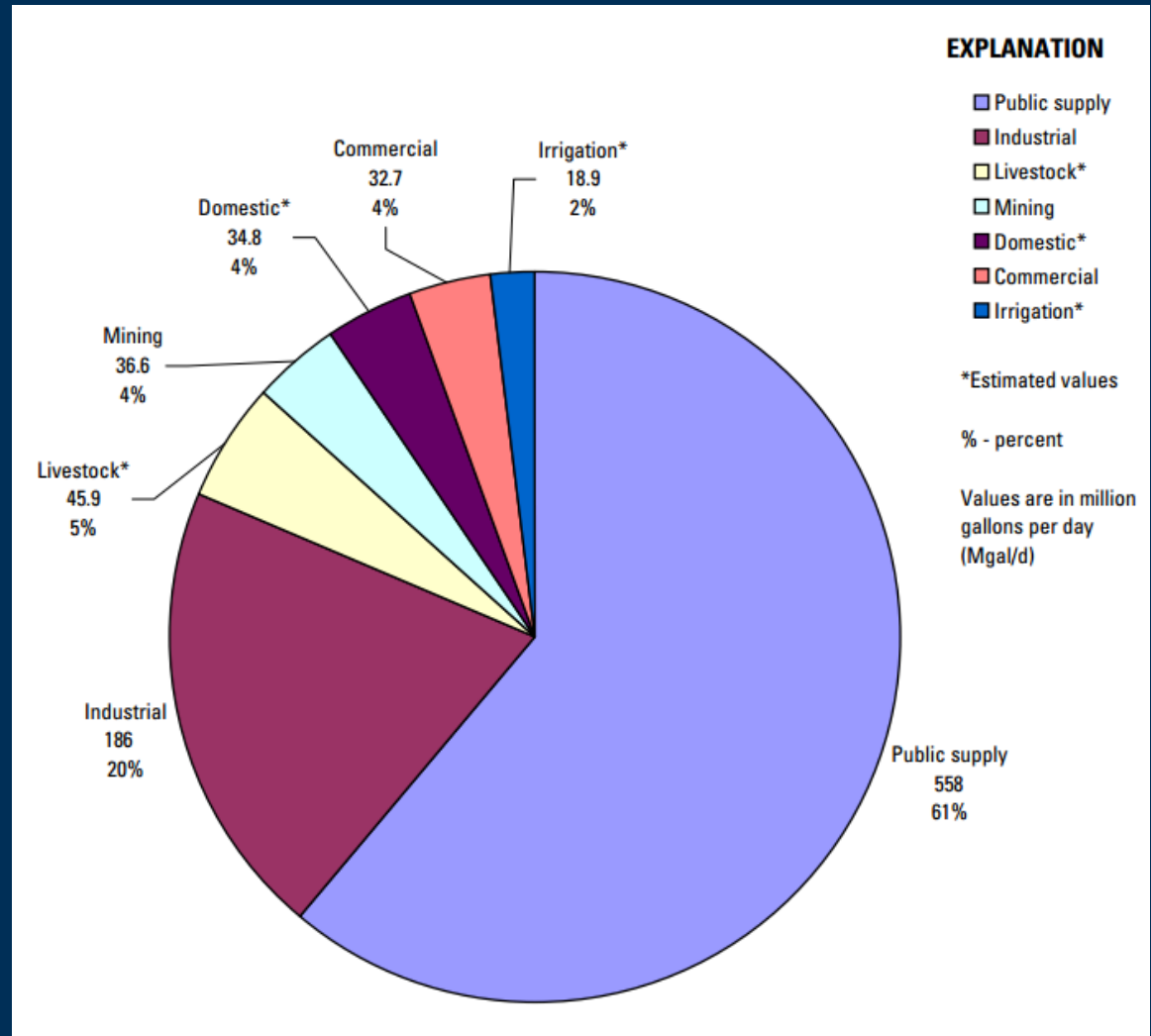


# Water use in Kentucky

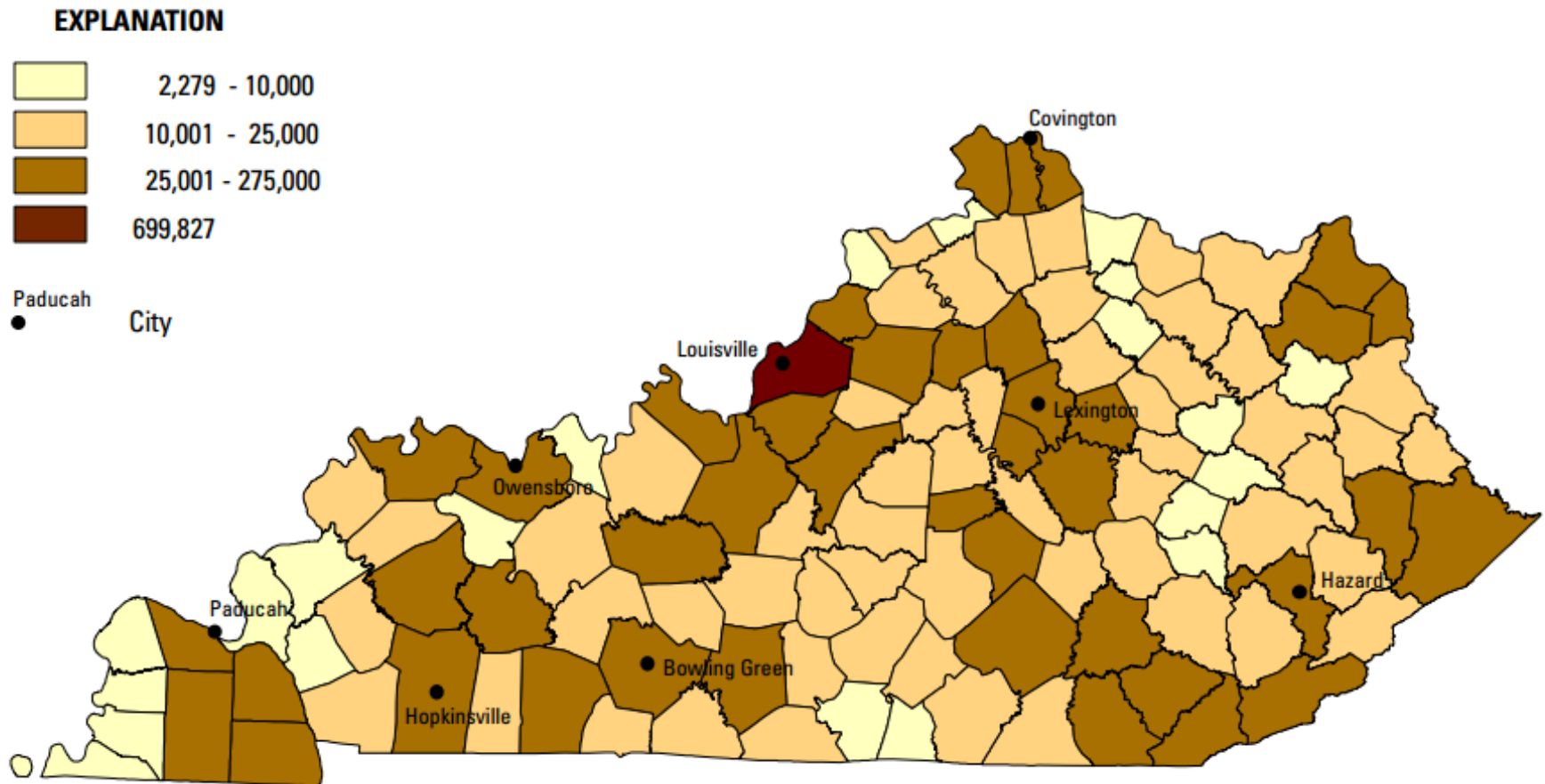
# Total water withdrawals in Kentucky, 2005



# Total water withdrawals in Kentucky, 2005, without thermoelectric power



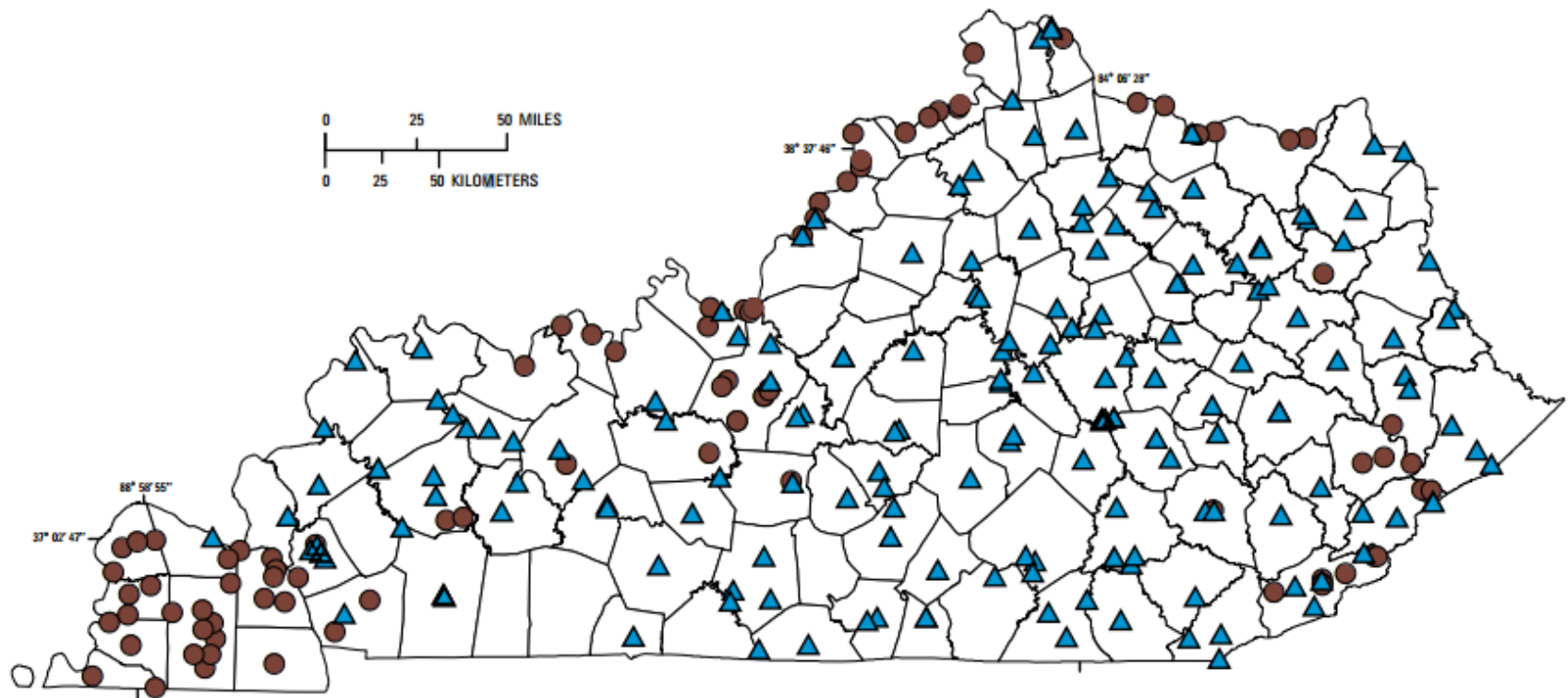
# Total population in Kentucky, 2005



# Location of permitted public water-supply withdrawals in Kentucky, 2005

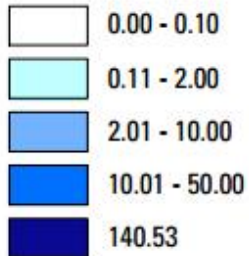
## EXPLANATION

- ▲ Surface-water-withdrawal site
- Ground-water-withdrawal site



# Permitted public water-supply withdrawal ranges and surface- and ground-water withdrawal totals in Kentucky, 2005

### EXPLANATION

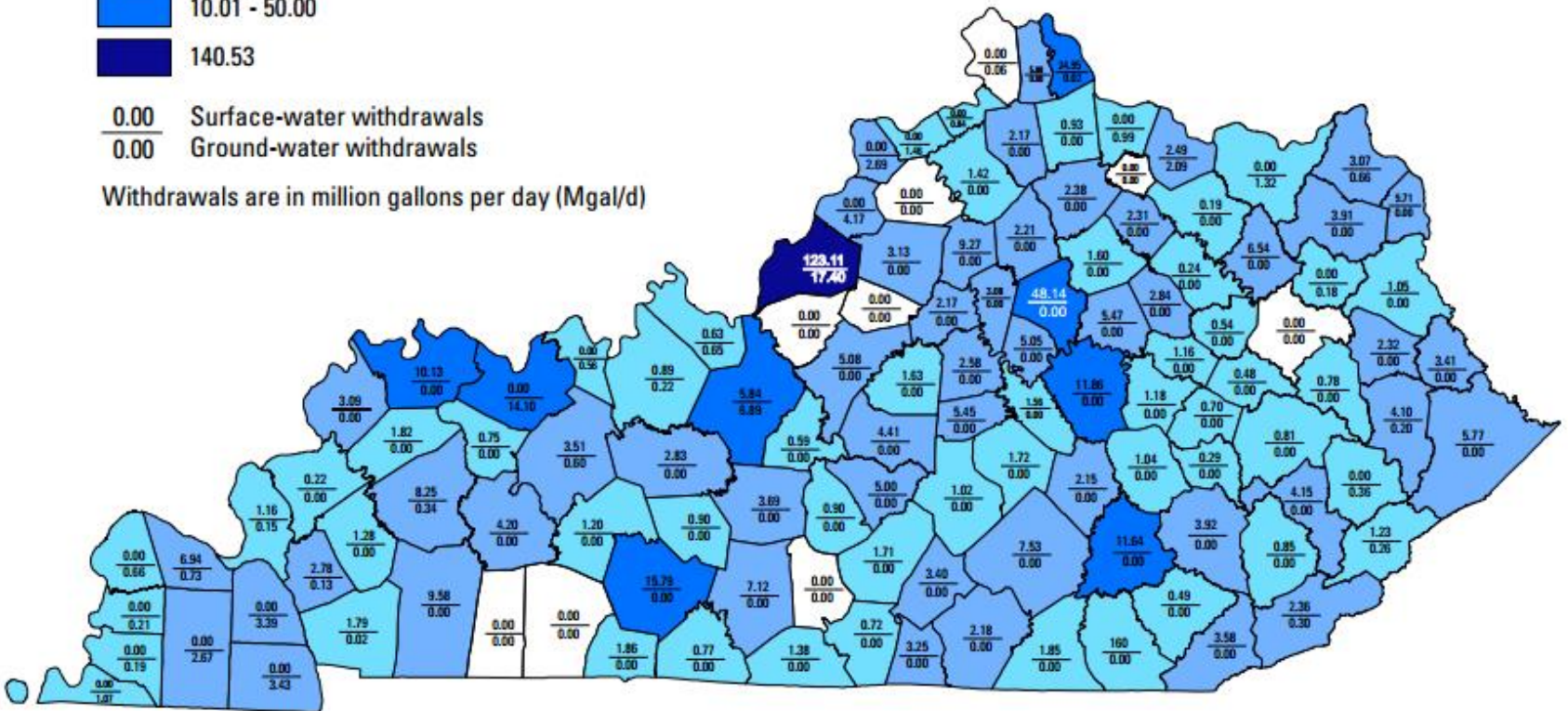


0.00 Surface-water withdrawals

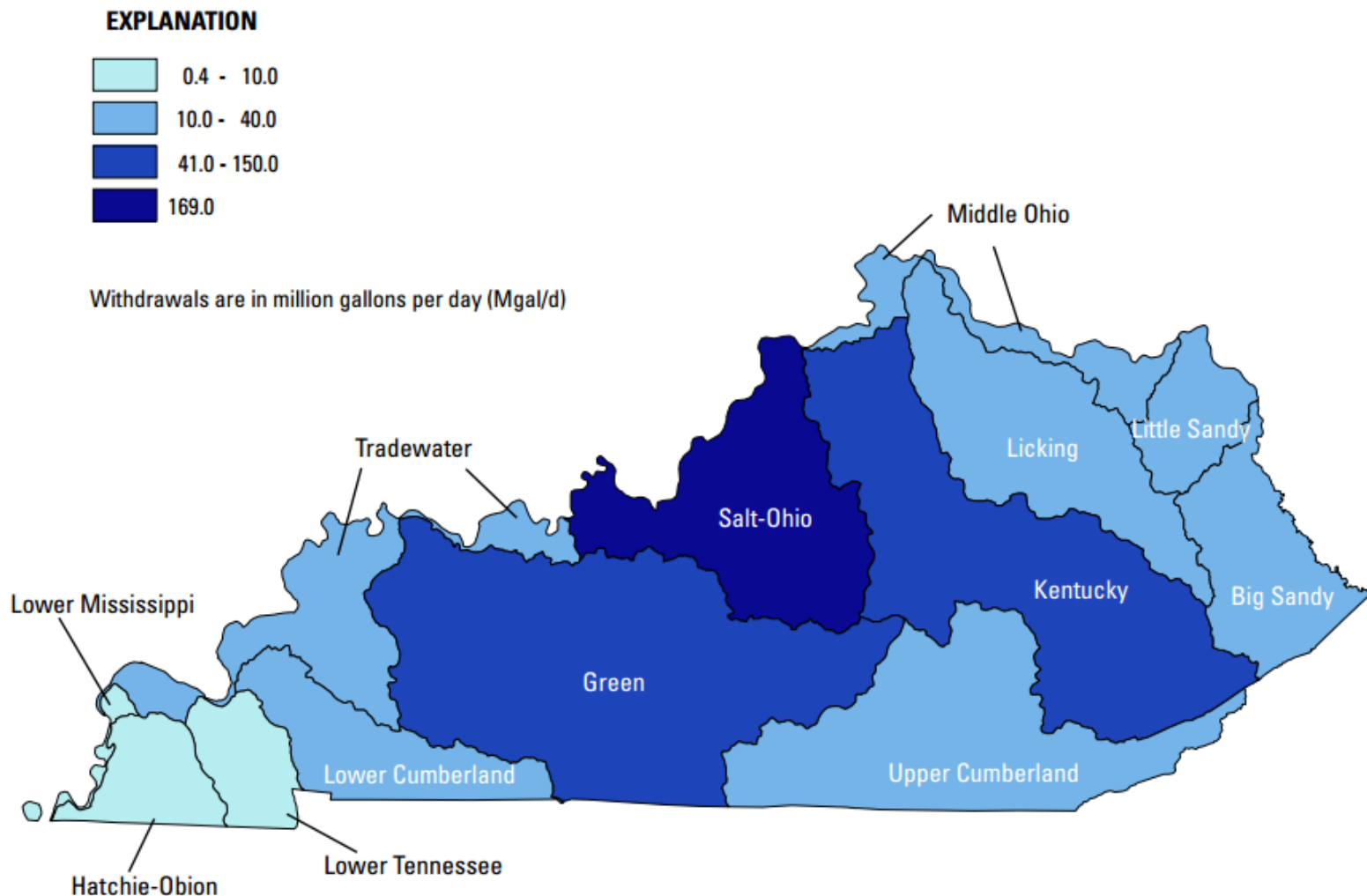
0.00 Ground-water withdrawals

Withdrawals are in million gallons per day (Mgal/d)

Of the total permitted public water-supply withdrawals, 489 Mgal/d (88 percent) came from surface-water sources, and 69 Mgal/d (12 percent) came from ground-water sources.



# Average annual permitted public water-supply withdrawals, by watershed, in Kentucky, 2005

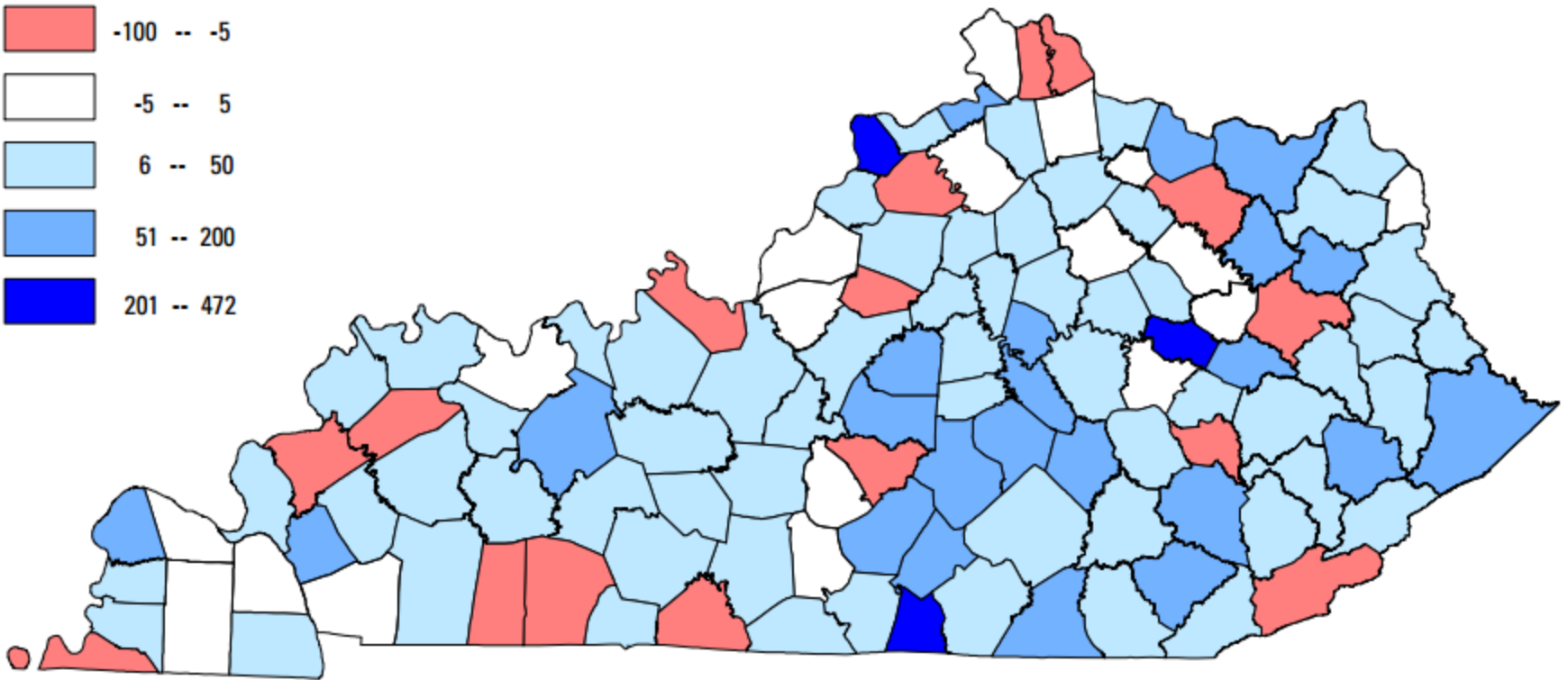
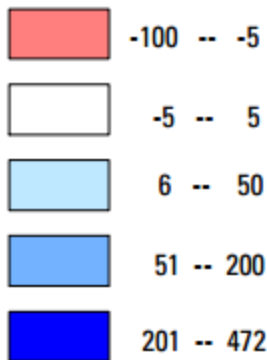




# Percent change in permitted public water-supply withdrawals in KY, 1995–2005

Small increases and decreases in permitted public water-supply withdrawals can be attributed to population changes. Large increases and decreases can be attributed to merging of supply systems, change(s) in source, or purchases from other counties.

## EXPLANATION





# Population change and permitted public water-supply withdrawal change in KY, 1995–2005

A rise in population does not necessarily show a corresponding rise in public water-supply withdrawals. Increased water demand may be met by water withdrawn from outside the respective county or outside Kentucky and transferred into the county. Additionally, an increase in public water-supply withdrawals in counties with a decrease in population may reflect the State's efforts to provide water to unserved and under-served areas.

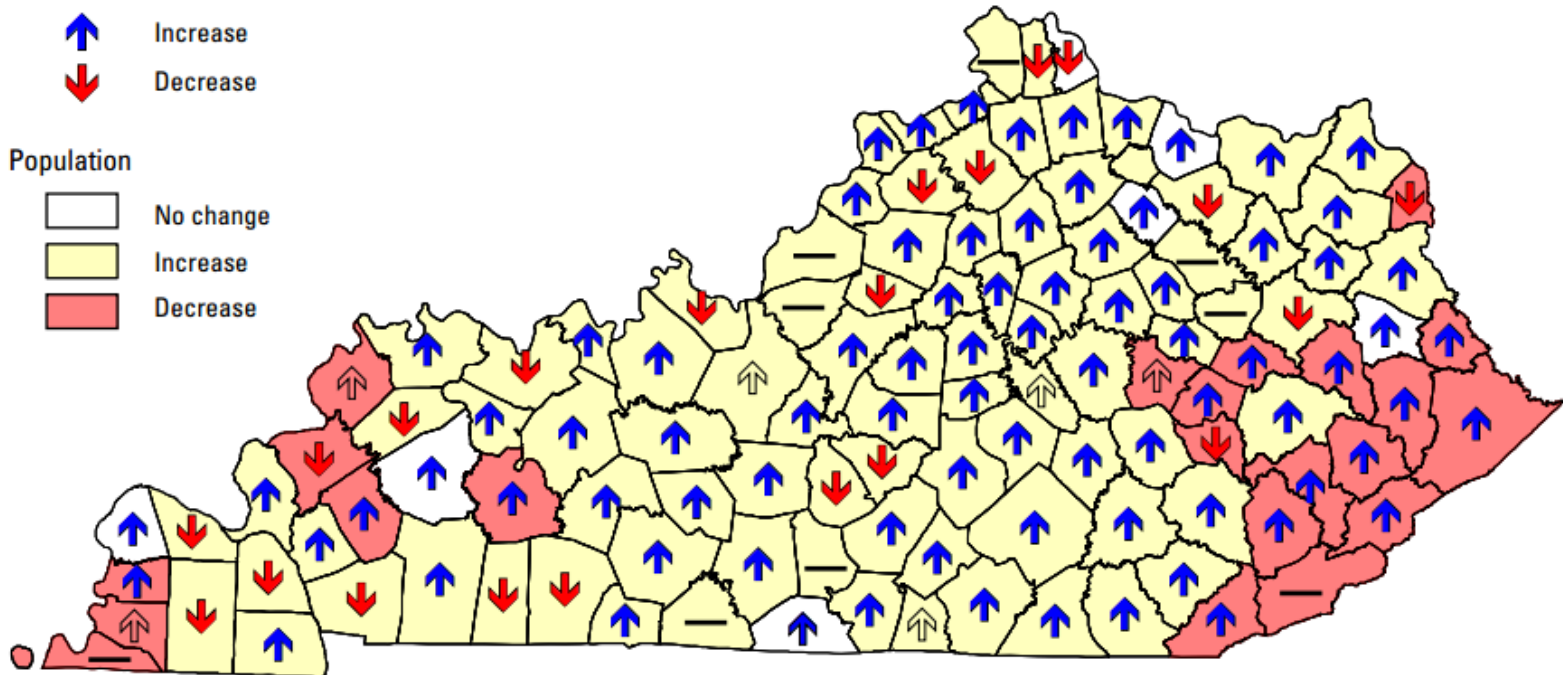
## EXPLANATION

### Withdrawals

- No change
- ↑ Increase
- ↓ Decrease

### Population

- No change
- Increase
- Decrease

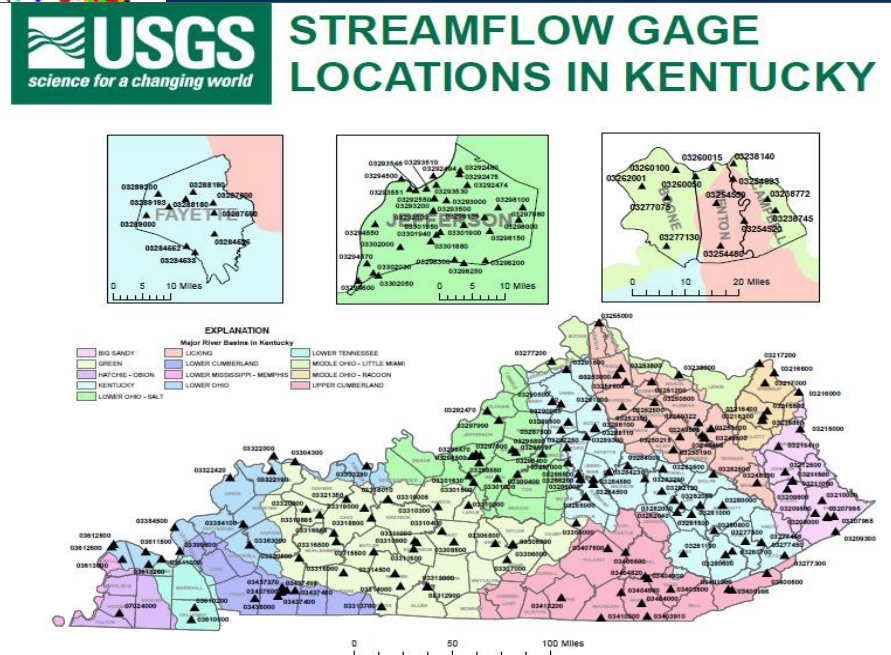
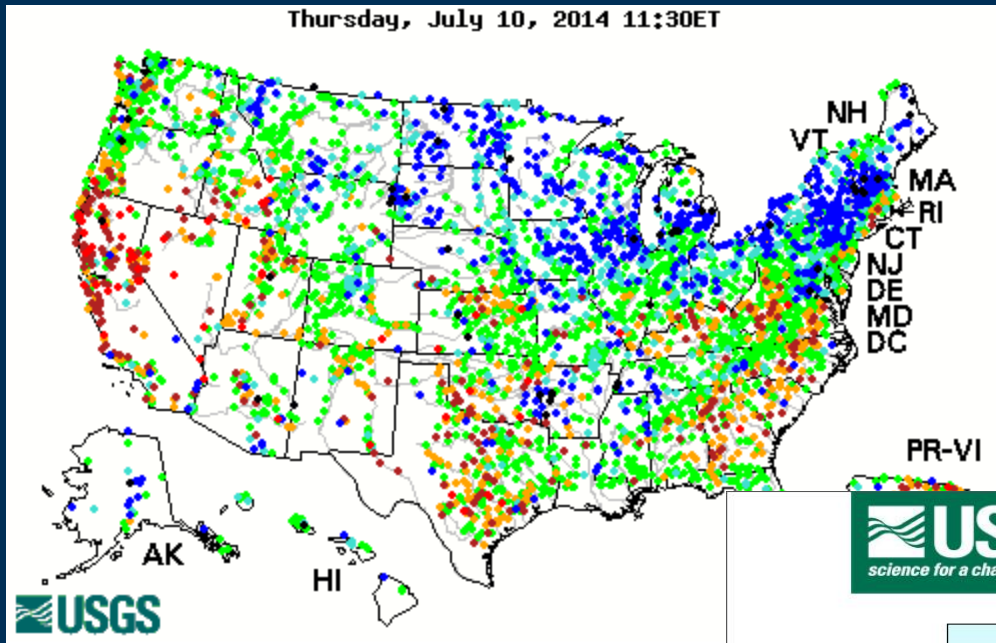


# Hydrologic monitoring networks

How do you know the  
impacts of water use?

**Approximately 210 sites  
in Kentucky with real-  
time streamflow data**

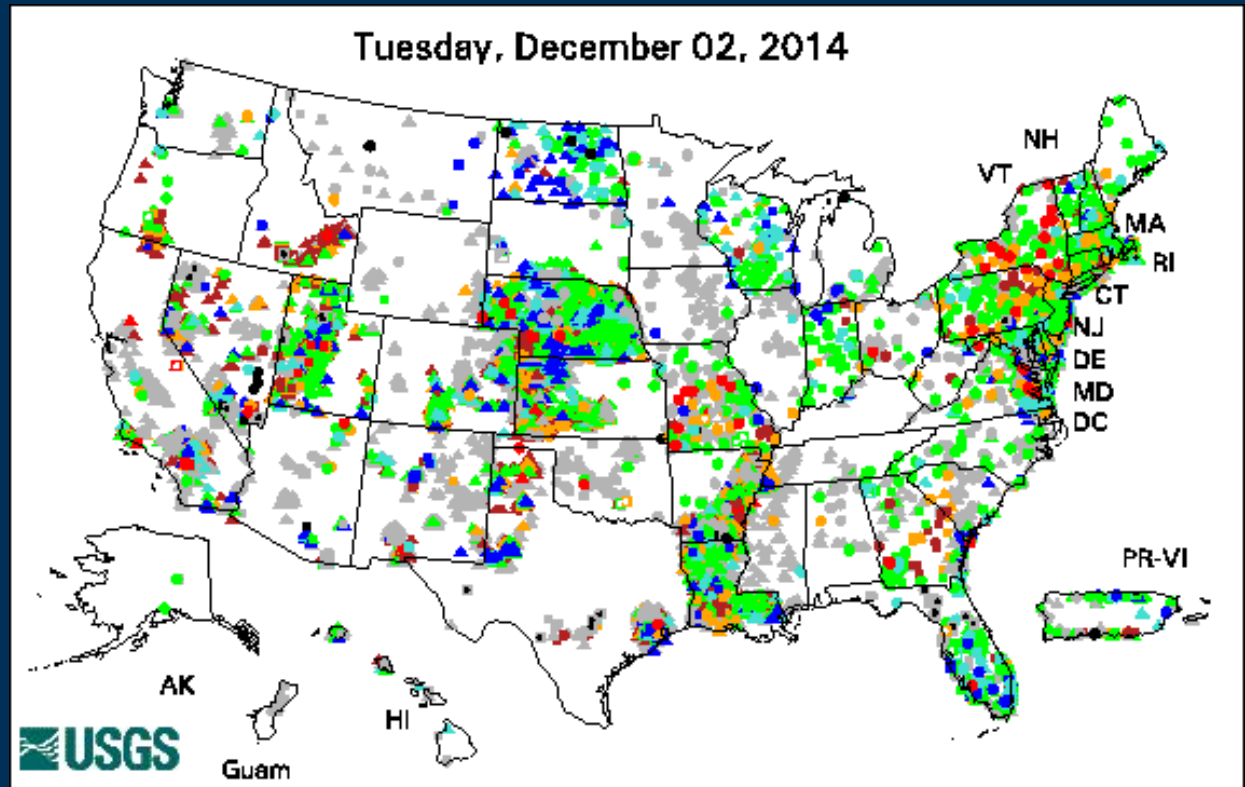
Approximately **14,800**  
sites nationally with  
real-time streamflow  
data



# Groundwater – real-time observation wells

Only **one (1)** site in Kentucky with real-time groundwater data

Approximately **1,650** sites nationally with real-time groundwater data (~**854,000** sites in database)



# Hydrologic monitoring networks

How do we quantify  
surface water?



# Real-Time Streamflow gages



# What is a USGS Gaging Station?

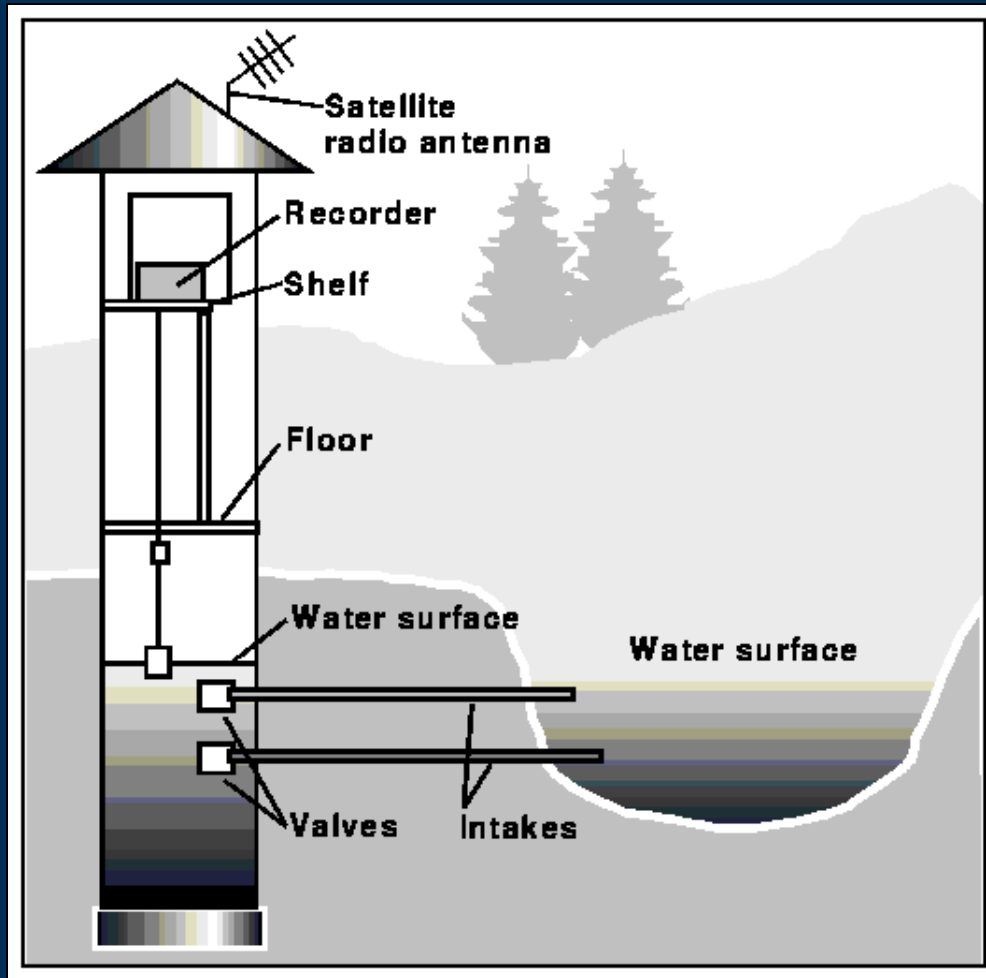
*A device that can provide continuous information on precipitation, surface-water quantity and quality, or groundwater.*

*USGS has been operating gages in Kentucky since ~1907 (data is still readily available!)*





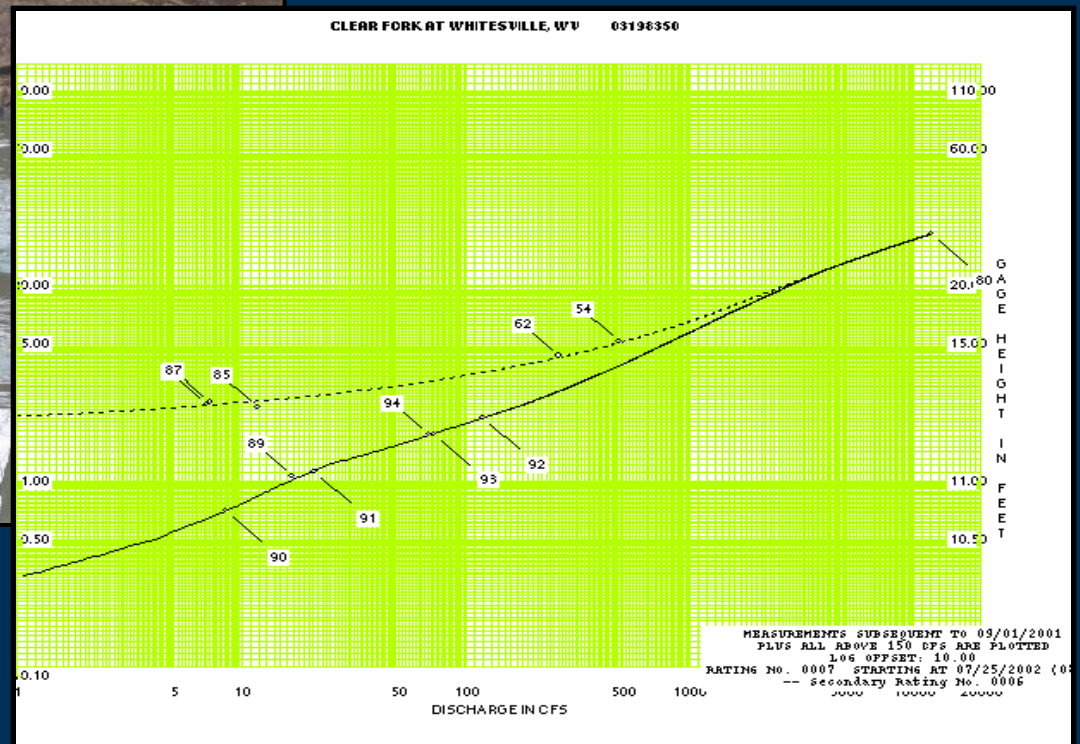
# *How does a stream gage work?*



It tracks the water-level (stage) as it rises and falls using various techniques that are dependent on the site.



*Stage data typically becomes streamflow (CFS) by means of a rating curve – this requires expertise in hydrology and hydraulics.*



# *How does a stream gage work (with modern non-contact sensors)?*

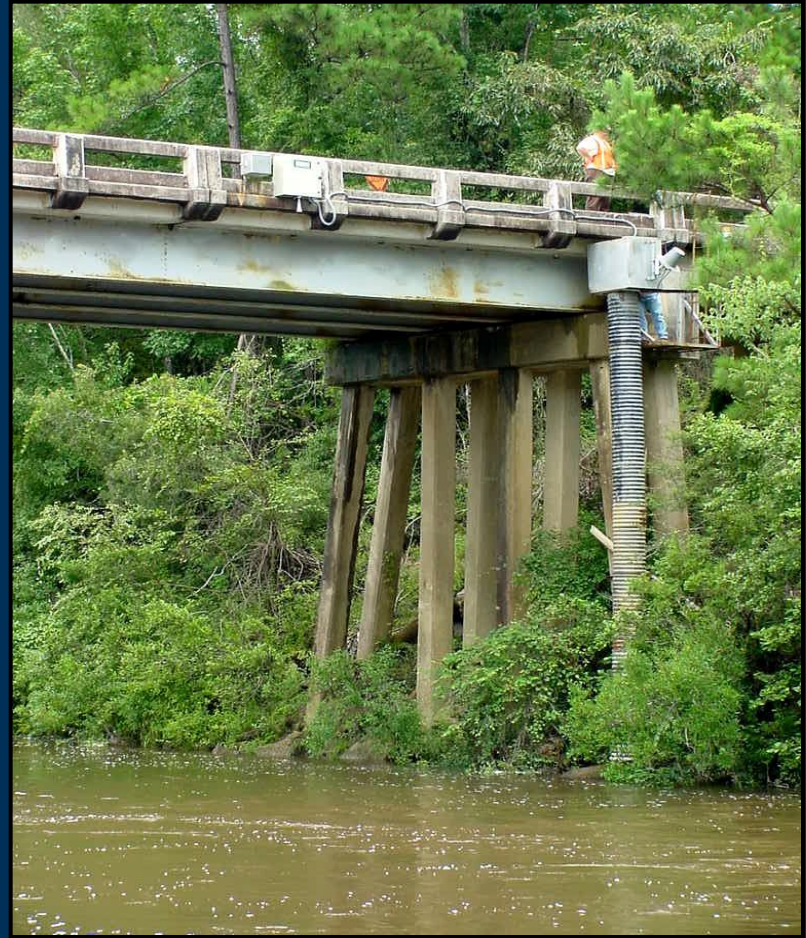
## Acoustics

Note that much of  
this acoustic  
technology is  
developed in  
Kentucky by  
USGS  
Hydrologists,  
Dave Mueller and  
Justin Boldt.



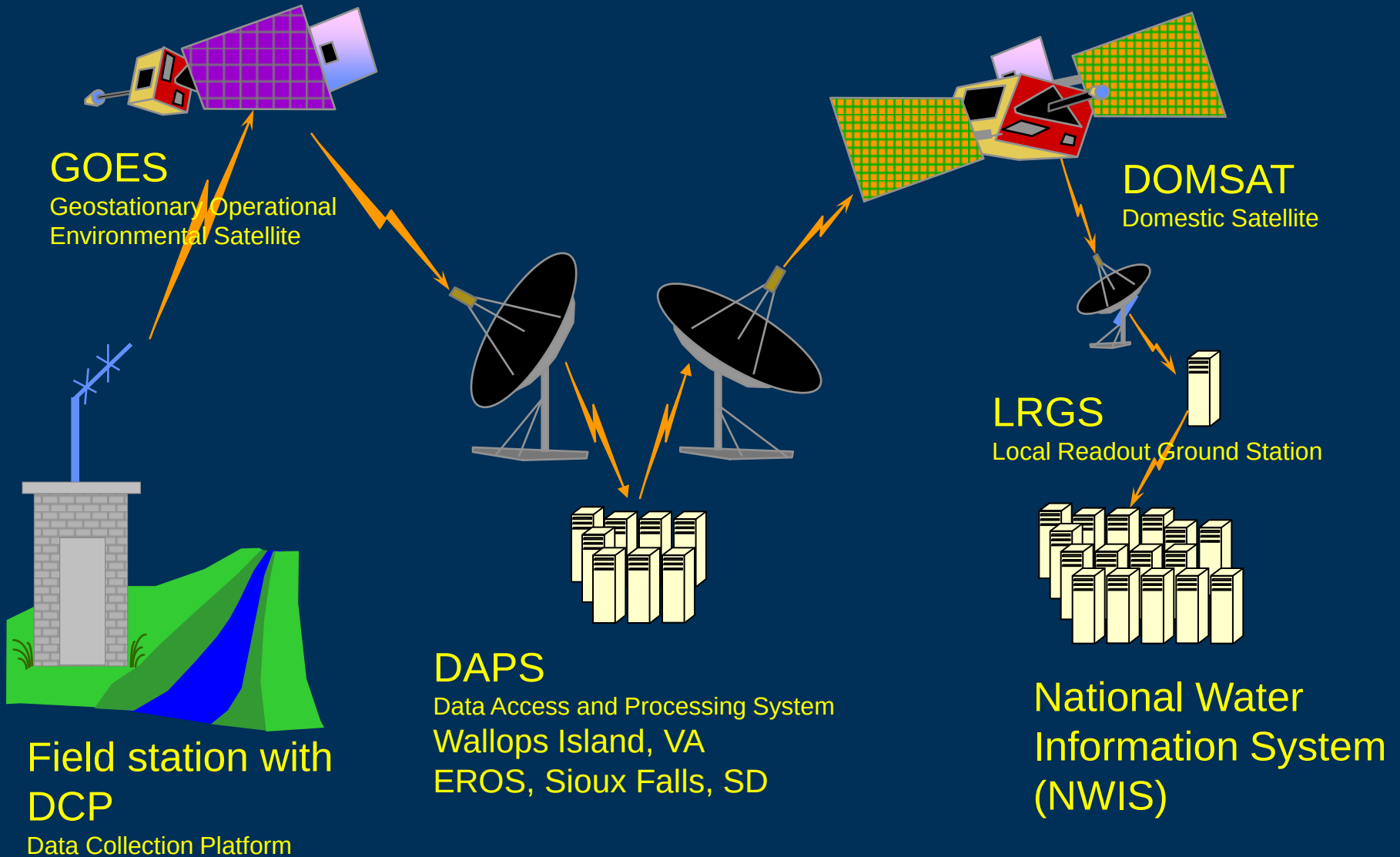


# *How does a stream gage work (with modern non-contact sensors)?*

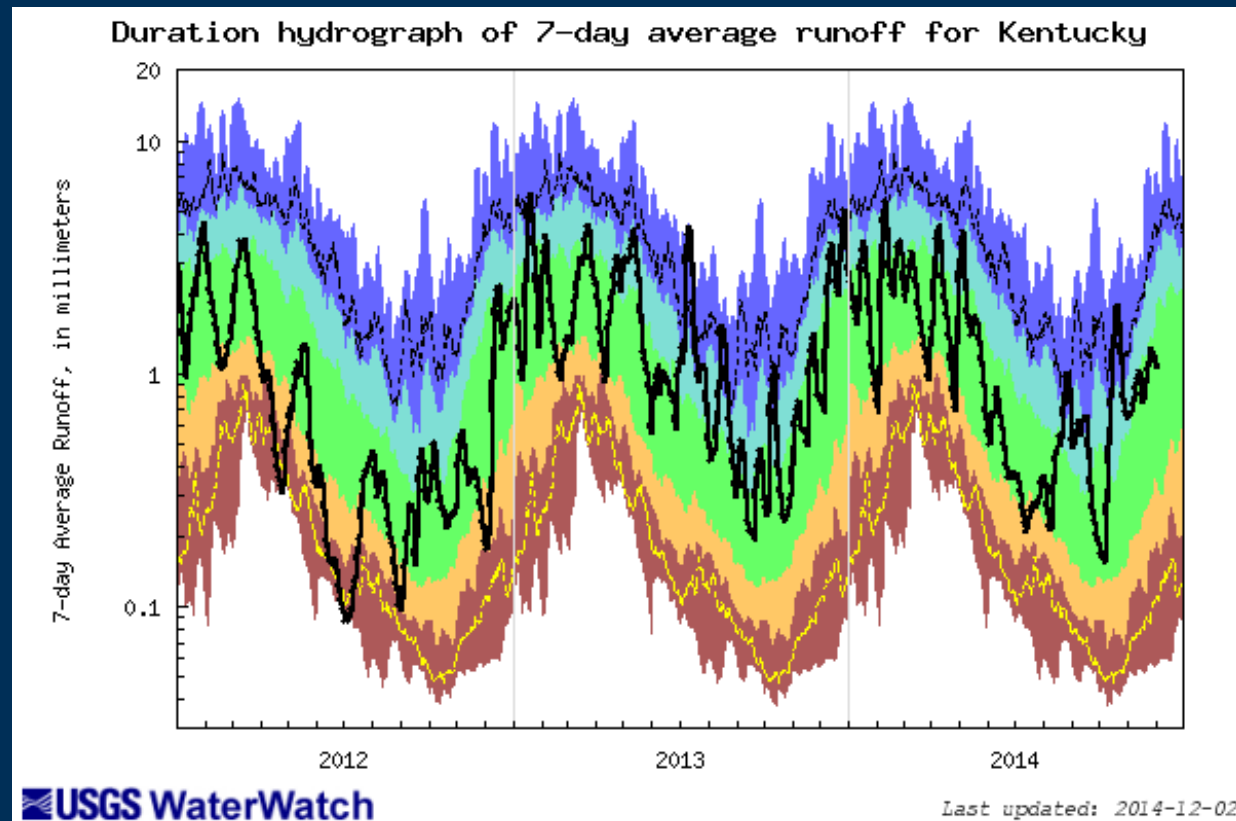


## Radar

# USGS GOES near real-time Data Collection System



Due to our gage network, we have a decent idea about surface water in Kentucky – not perfect, but we can paint a picture.



| Explanation - Percentile classes |              |        |              |                   |    |                           |
|----------------------------------|--------------|--------|--------------|-------------------|----|---------------------------|
| lowest-10th percentile           | 5            | 10-24  | 25-75        | 76-90             | 95 | 90th percentile - highest |
| Much below Normal                | Below normal | Normal | Above normal | Much above normal |    | Runoff                    |

# Hydrologic monitoring networks

How do we quantify  
groundwater?



# Real-Time Ground Water Observation Wells

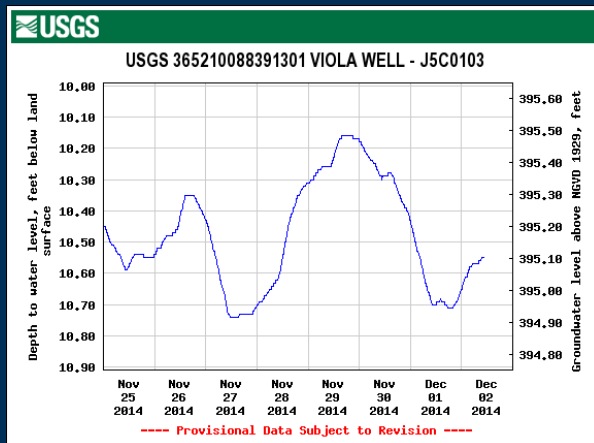
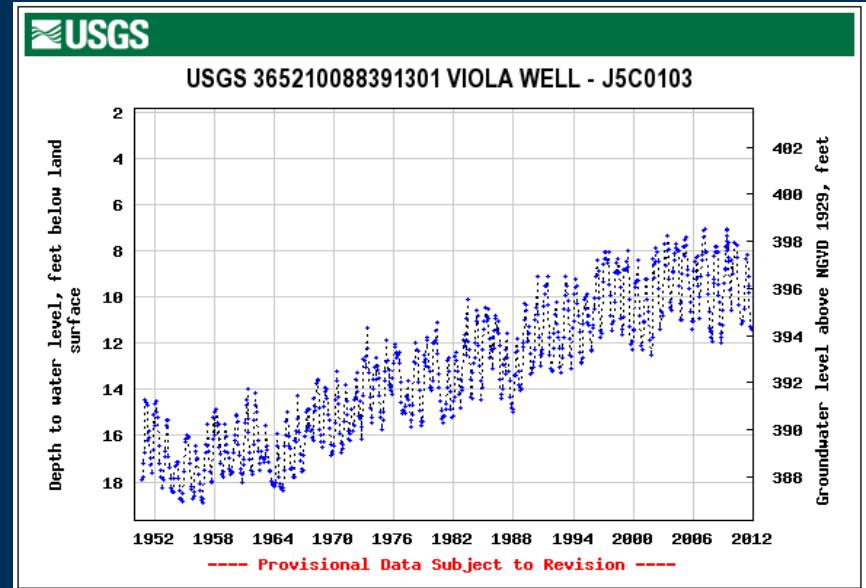
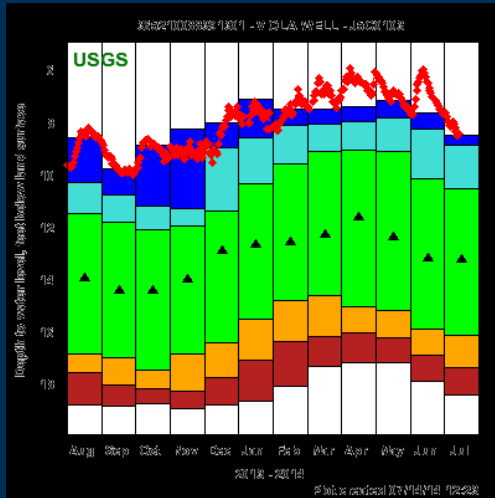
Typically, much easier to operate (hence cheaper); however, the devil is in QA/QC (drift, etc.), telemetry, and data management! There's doing it and then there's doing it right.

For example, USGS spends ~\$4.5M each year to operate our database that reaches back over a century (it is an enormous database).





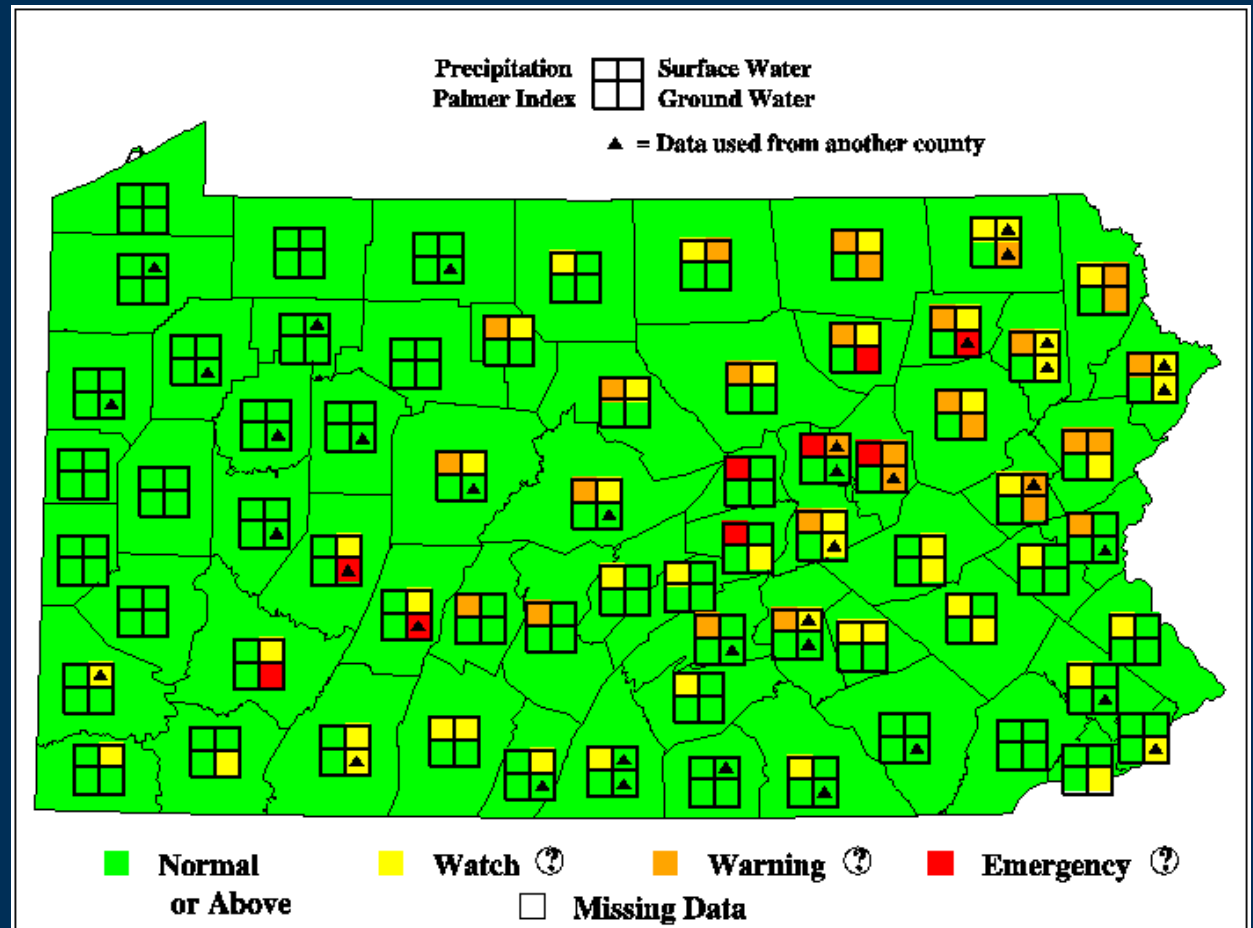
# Our 1 Real-Time Ground Water Observation Well Viola well – active since ~1950



Provides great information, but it's only ONE point in Kentucky – Nationally, it's part of a large comprehensive network, but locally (beyond that immediate area), it tells us very little about Kentucky.

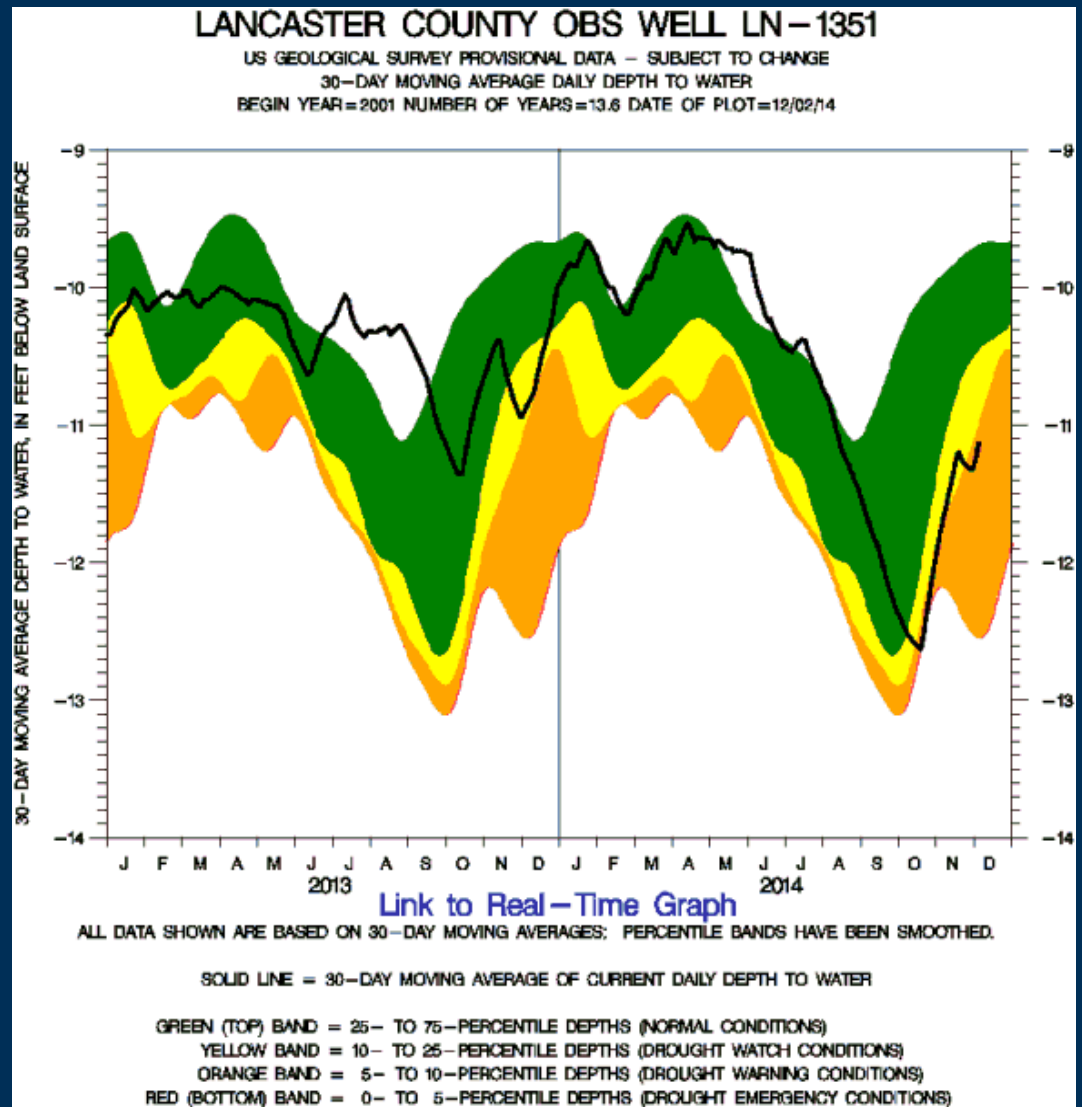
Ideally, groundwater is part of a comprehensive local network (as in Pennsylvania and other states) –

We do not have this ability in KY.



Observation wells in a optimized network can tell us something about regional / local groundwater availability and resources.

The PA network is developed by county due to the local hydrogeology, a KY network would likely use a different criteria (aquifer).



# Hydrologic monitoring networks

Where do I find this  
data?

# USGS Water Watch

**Surface water:**

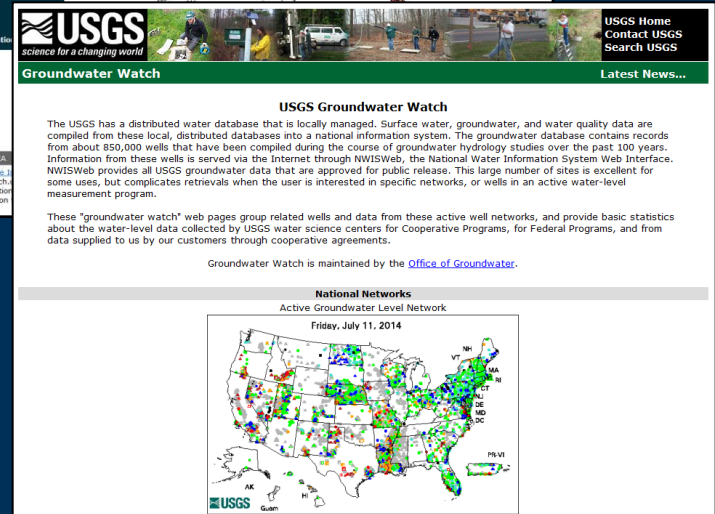
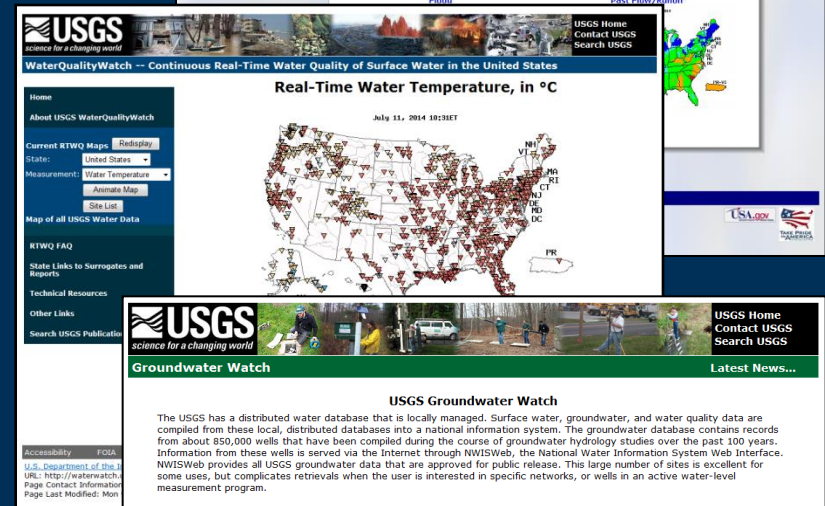
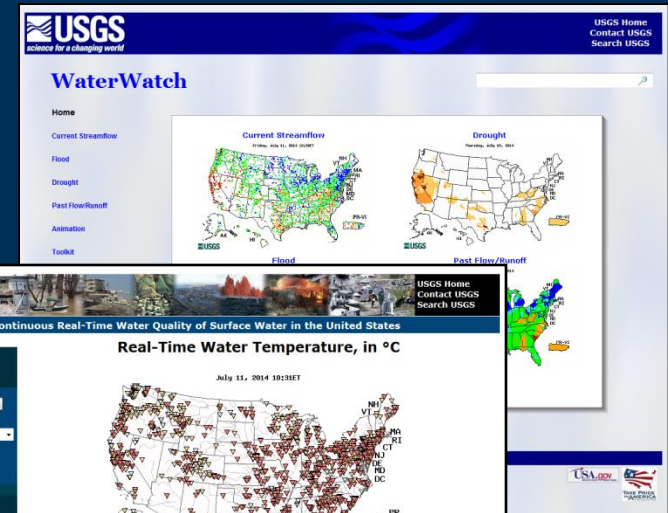
<http://waterwatch.usgs.gov/>

**Water quality:**

<http://waterwatch.usgs.gov/wqwatch/>

**Groundwater:**

<http://groundwaterwatch.usgs.gov/>



# NWISWeb – <http://waterdata.usgs.gov/ky/nwis>

- These pages provide access to water-resources data collected at approximately 1.6 million sites in all 50 States. This number is constantly growing.
- **KENTUCKY:**
- Approx. 14,750 total sites
- Approx. 210 real-time sites
- Approx. 100 rain gages
- Approx. 315 daily SW data sites
- Approx. 350 sites for Peak Flow Data
- Approx. 900 sites for field measurements
- Approx. 8,200 sites of GW field meas.
- 1 real-time GW well
- Approx. 50 real-time QW sites
- Approx. 5,200 field/lab samples
- Water Use data from 1985-2010

## USGS Water Data for Kentucky

Click to hide state-specific text

### Search for Sites With Data

Current Conditions

Sites with real-time or recent surface-water, groundwater, or water-quality data.

Site information

Descriptive site information for all sites with links to all available water data for individual sites.



Map of all sites with links to all available water data for individual sites.

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### Frequent Searches By Data Category

Surface Water

Water flow and levels in streams and lakes.

Groundwater

Water levels in wells.

Water Quality

Chemical and physical data for streams, lakes, springs, wells and other sites.

Water Use

Water use information.



# Summary

What data there is does not point to any specific current issue other than some areas with a dependency on GW are also agricultural areas that could develop GW-based irrigation systems. KY falls well below other states in water use.

HOWEVER, we have virtually NO GW observation-well data outside of Louisville and some small project areas – any conclusions regarding state-wide GW are speculation at best. The existing KY streamflow-gaging network is also shifting into urban areas (same # of gages, but less statistical strength in rural areas).

# Questions?

## Contact information:

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<https://profile.usgs.gov/pcinotto>

